COPY FOR MR. J. ALLAN ROSS



HYDRO-ELECTRIC INQUIRY COMMISSION

ENGINEERING DATA

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

DESCRIPTION OF PLANT

WALTER J. FRANCIS & COMPANY CONSULTING ENGINEERS







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Walter J. Francis.

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THE ONTARIO POWER COMPANY OF RIAGARA FALLS

DESCRIPTION OF PLANT

Walter J. Francis.

Historical.

The original plant of The Ontario Power Company of Miagara Falls was designed by Hossra. P. N. and L. N. Nunn and was put into service immediately after its completion in 1906. The Company continued the operation of the plant until it became the property of the Hydro-Electric Power Commission of Ontario in 1917, since which period the plant has been operated by the Commission through its Operating Department.

The power house as originally laid out was built by successive stages, and the final addition was made in 1919.

General Description of the Flant.

Location.

The plant is located on the Canadian side of the Niagara River in the immediate vicinity of the Horseshoe Falls, the headworks being at the water's edge about a mile upstream from the Falls, and the power house, likewise at the water's edge, immediately below the Falls.

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The general location and arrangement of the plant will be seen by reference to Drawing No. 1, being page 5 hereof.

The Headworks.

The beadworks consists of an intake, an outer forebay, a screen house, an inner forebay and a gate house closely grouped together, and as a whole forming the entrance for the water to the main conduits conveying it to the power plant. All the structures of the headworks are of a permanent character, built of concrete, reinforced concrete and artificial stonework, the principal buildings being monumental in lesign.

The Conduits.

Three underground conduits convey the water from the headworks to the penstocks leading to the turbines in the power house. The conduits are approximately 6,500 feet in length. The alignment of the conduits is generally parallel to the shore, several handred feet landwards, and is by ourves of long radius, through a deflection of nearly minety degrees to the right as one travels from the head-gates to the penstocks. The conduits have a total drop of 28 feet from the head-gates to the penstocks with a grade which is almost uniform.

The first of the conduits to be constructed was made of steel plate and is designated No. 1. It is the most westerly of the three, the general line of the conduits being in a northerly direction. This conduit is of

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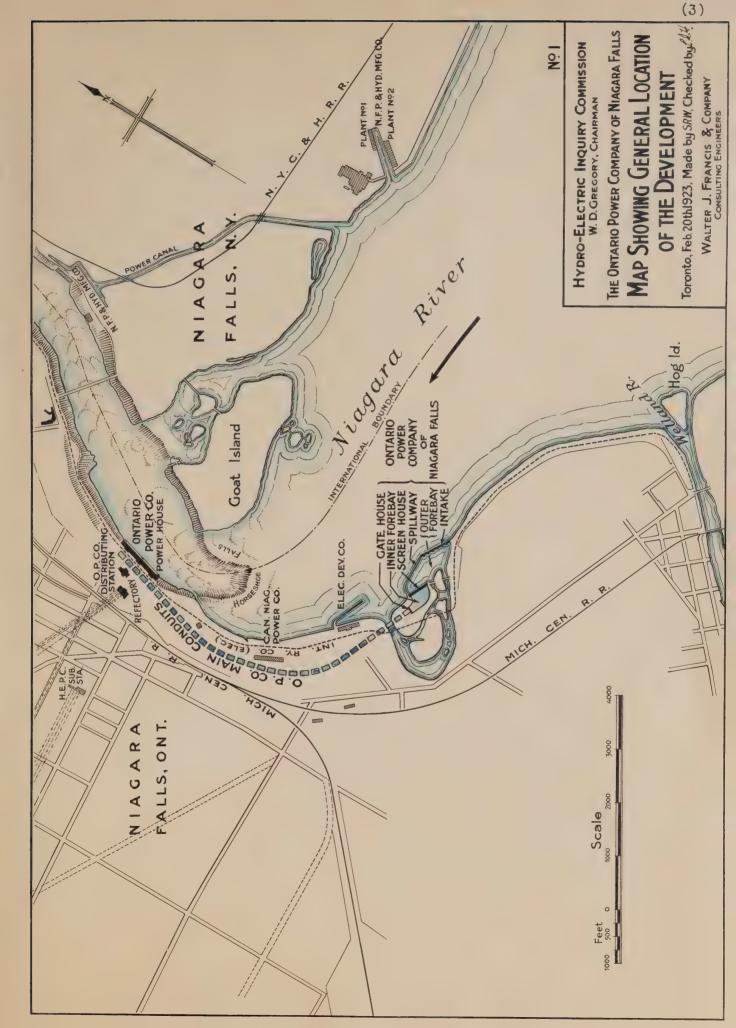
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circular section with an internal diameter of 18 feet.

The second conduit which was built is constructed of reinforced concrete, and is adjacent to conduit No. 1 and on the river side thereof. It is known as conduit No. 2. The section of conduit No. 2 is that described technically as a "hydrostatic chord", and has an area equivalent to that of a circle 18 feet in diameter. It was constructed in the years 1909 and 1919.

The third conduit, known as conduit No. 3, was completed in 1919. It is adjacent to No. 2 and on the river side thereof. It is a wood-stave conduit of circular section, measuring 13 feet 6 inches in internal diameter.

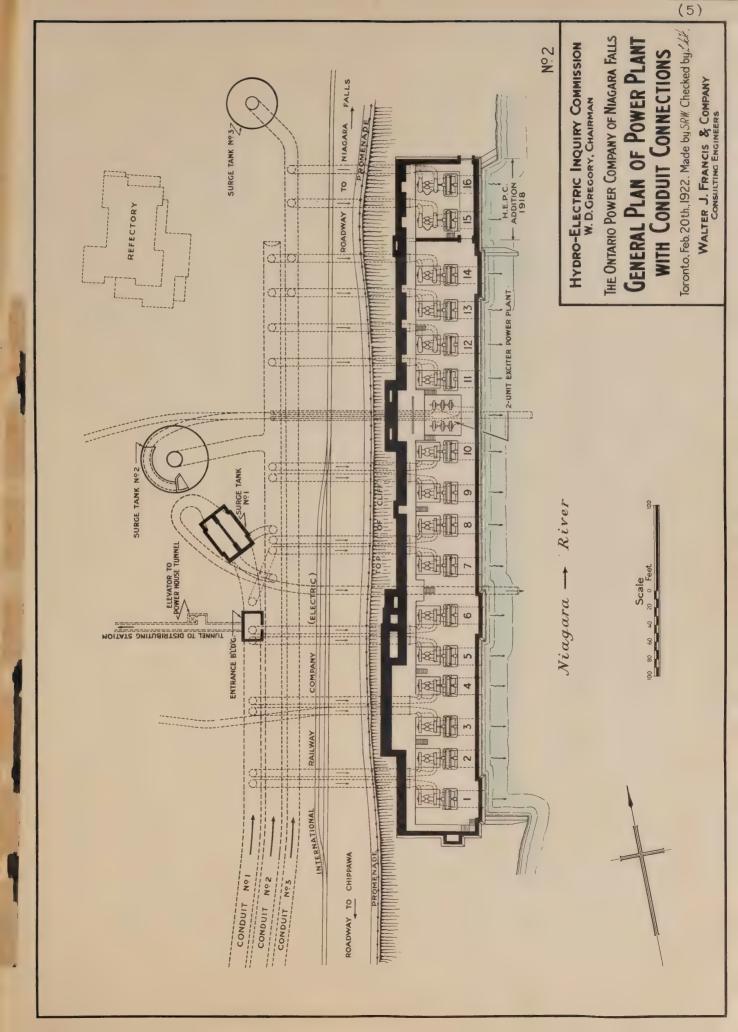
The water of the river is admitted to the conduits by means of Stoney sluice head-gates, there being one bad-gate for each conduit, all located in the gate-house.

The Surge Tanks.

Three surge tanks, known as Nos. 1, 2 and 3, and located as shown on Drawing No. 2, being page 5 hereof, act as regulators on the main conduits. The connections of the surge tanks to the conduits will be seen by reference to Drawing No. 2.

Surge tank No. 1 was originally built in connection with conduit No. 1, while surge tank No. 2 was similarly constructed with conduit No. 2. Both are of monumental design. Surge tank No. 3 was constructed at the same time as conduit No. 3, and is an exposed steel tank 60 feet in dismetor, of utilitarian design corresponding to an ordinary municipal waterworks stand-pipe.

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All the surge tanks are located on the natural surface of the rising ground between the top of the cliff and the hillside a short distance land-wards.

The Penstocks.

Sixteen steel penstocks convey the water from the conduits to the main units in the power house, one penstock for each main unit. The arrangement of the penstocks and their interconnectious to the conduits will be seen by reference to Drawing No. 2, a typical section being that of the penstock for main Unit No. 15 as shown on Drawing No. 3 included as page 7 hereof. All the penstocks are of steel ambedded in concrete which entirely fills the shaft excavated therefor in the rock. The penstocks for main units Nos. 1 to 12 inclusive are 9 feet in diameter; for main units Nos. 13 and 14, 9 feet 6 inches in diameter; and for Nos. 15 and 16, 10 feet 6 inches in diameter. On each of the penstocks immediately below the conduits there is a controlling valve, that on the penstocks for main units Nos. 1 to 11 being of the gate type and for Nos. 12 to 16 of the Johnson plunger type.

Special penstocks lead from conduit No. 2 to the two-unit exciter plant in the power house independently of the main units.

The Fower Bonso.

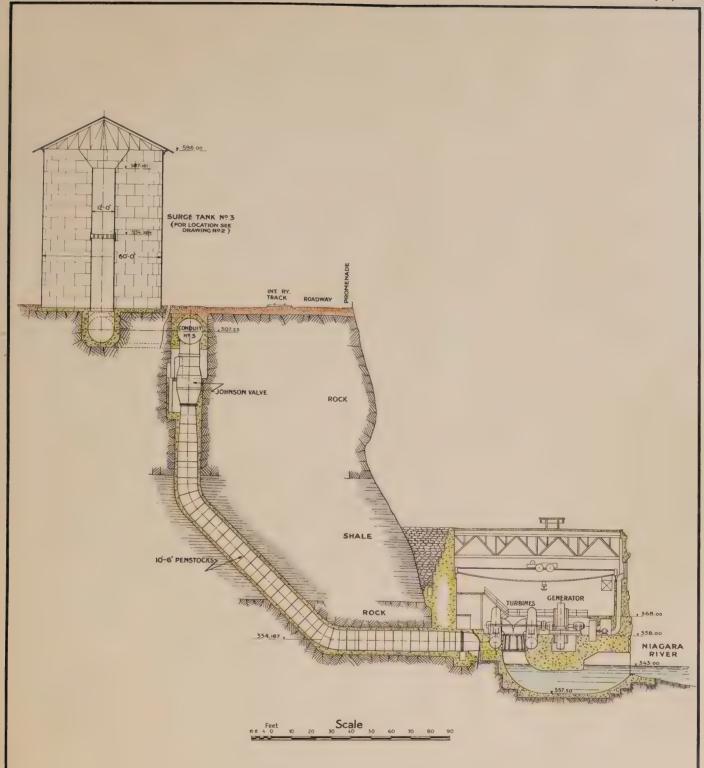
The power house located at the water's edge at the base of the cliff is about 780 feet in length. It is a fireproof structure built of reinforced

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HYDRO-ELECTRIC INQUIRY COMMISSION W. D. GREGORY, CHAIRMAN

THE ONTARIO POWER COMPANY OF NIAGARA FALLS

GENERAL CROSS SECTION OF POWER PLANT THROUGH CONDUIT AND POWER HOUSE AT UNITS 15 & 16

Toronto, Feb. 20 TH 1922. Made by SRW, Checked by L.H.

WALTER J. FRANCIS & COMPANY CONSULTING ENGINEERS



concrete. The roof trasses are of steel, the roof slab is of reinforced concrete with the exposed surface of the roof finished in tiles.

In the original plant there were fourteen main units in addition to the exciters. Later, main units Nos. 15 and 16 were added. The turbine rating of main units Nos. 1 to 7 is 11,800 horse-power; of Nos. 8 to 12, 15,000 horse-power; and of Nos. 15 and 14, 16,000 horse-power each. The turbine rating of Nos. 15 and 16 is 18,000 horse-power each. All of these units are of the horisontal-shaft type, and the turbine head is about 180 feet. The generators are set with the shafts in the same horizontal plane about 5 feet above the power house floor, and the centre of the rotor of every generator is placed in the same straight line from end to end of the plant.

A two-unit exciter plant is located between main units Nos. 10 and 11.

A gallery on which the governor mechanism is located extends from end to end of the building at an elevation of about 10 feet above the power house floor.

The draft tubes discharge directly over a weir into the river.

The general relation of the various parts will be seen by reference to Drawings Nos. 2 and 3.

The Transformer and Distributing Station.

The transformer and distributing station of the plant is located on top of the hill about 500 feet from the top of the cliff at the rear of the power house. Communication is established between the power house and the transformer station by tunnels and by shafts wherein elevators are installed.

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The location of the small entrance building beside the promonade and roadway may be seen on Drawing No. 2, while the general location of the transformer house and distributing station on the hill will be seen by reference to Drawing No. 1.

The distributing station is a fireproof bailding several stories in beight, of ormate design, and situated in grounds beautifully laid out.

The building contains the switching, operating and control apparetus, as well as the high tension equipment.

The Hydro-Elentric Power Commission Addition.

During the years 1918 and 1919 the Sydro-Electric Forcer Cormission of Contario made the last important addition to the plant, consisting of the installation of two complete waits in a building which was a continuation of the original power boase in a northerly direction, the original northerly wail forming a dividing wall between the older part of the plant and the new. The two new units were designated No. 15 and No. 16, continuing the nomendature of the original plant so that machine No. 16 was adjacent to the dividing wall, No. 16 cocupying the more northerly position. Each of the two new units had a turbine rating of 18,000 horse-power, and was generally similar in type and design to the original units. Both generators were set as before with the rotor in the same line as all the others, but at an elevation 10 feet lower.

The substructure and the walls of the addition were of concrete, and the floors and galleries were of reinforced concrete. The roof slab was

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likewise of reinforced concrete, and was supported by steel truss girders.

Unit No. 15 and Unit No. 16 were of the same capacity and were identical in detail. The turbines and the generators were manufactured by the same firms, part by part. The turbine of each unit is a horizontal-shaft, double spiral casing, Francis turbine, and the generator of each unit is an alternating current generator of 15,000 kilovolt-ampere capacity at 75 per cent. power factor and at 12,000 volts.

The turbines were manufactured by the 3. Morgan Smith Co. of York.

Pennsylvania, and it is understood that they were originally intended for the use of a French Aluminum Corporation. Nater becoming the property of The Aluminum Company of America. Owing to a change in the proposed plan of development. The Aluminum Company finally decided not to use the turbines, and by sutual arrangement they were accepted for use in the new addition of the plant of The Ontario Power Company of Ningara Falls. The arrangement was concluded in April, 1918, and the turbines were erected during the early part of the year 1919.

The generators were manufactured by the Canadian General Electric Company. Peterborough, Ontario, on a special order for the work under date of January 12th, 1918, and were erected during the first half of the year 1919.

The governors were manufactured by The Lombard Governor Co., Ashland, Massachusetts, and the remainder of the machinery for the addition was supplied by standard makers.

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For the operation of these two units the Hydro-Electric Power Commission provided for an additional conduit, No. 3, of wood-stave construction, to convey the water from the intake works to the plant. This conduit, with its own sarge tank and ponstocks, provided a supply of water for the new addition independently of the older portion of the plant. Otherwise, all the conditions were similar to those obtaining in the older portion.

The total cost of the addition together with Units Nos. 15 and 16 and the auxiliary plant, and the conduit, surge tanks, and penstocks was \$3.514,686.62.

The contract price of the two generators complete and ready for service was \$550,000.00.

Unit No. 15 commenced operation on June 3rd, 1919, and Unit No. 16 on August 12th, 1919.

The Transmission System.

The distribution system was under the control of a subsidiary company of The Ontario Power Company of Niegara Palls styled The Ontario Transmission Company, Limited.

The map on page 11 shows the district in which the output of the plant was distributed, and it indicates also in a diagrammatic way the location of the transmission lines and the voltage when the system was acquired by the Hydro-Electric Power Commission. The high tension and the low tension substations are also shown thereon.

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Analysis of Cost of Mydro-Electric Fower Commission Addition.

For convenience of reference a series of four tables is attached hereto, containing an analysis of the cost of the addition made to the plant in 1918 and 1919 by the Hydro-Electric Power Commission. The headings of the various tables are self-explanatory. The references to estimated quantities and costs relate to the estimate made by the Hydro-Electric Power Commission in 1917.

I have studied the circumstances which led up to the construction of the addition, ultimately known as conduit No. 3 and Units 15 and 16, and I have gone over the matter carefully with the engineers of the Nydro-Riestric Power Commission, who have furnished no with the figures given in the tables.

The addition as originally conceived involved only the use of the residual capacity of the fourteen installed units of the plant, said to be approximately 25,000 horse-power, susceptible of reclamation by reducing the hydraulic head losses in conduit No. 1 and conduit No. 2. Comprehensively, therefore, this project comprised the installation of a third wood-stave pipe line of comparatively small diameter leading from the available connection at the gate-house and following along the surface contours as far as practicable down to a connection with No. 2 surge tank. This plan would have relieved the abnormal draft on conduit No. 1 and conduit No. 2, thereby increasing the head on the turbines.

While the above project was under investigation, it is stated that the load requirements for munition work became so urgent that the Hydro-Ricctric Fower Cosmission suddenly decided to purchase two second-hand turbines from

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The Aluminum Company of America and also to buy two new generators for connection thereto. This decision resulted in the deletion of the factors which entered into the original intention of the addition, and the whole problem became one of quickly installing a water connection between the headworks and the new turbines with sufficient independent capacity therefor. This involved the building of a wood-stave conduit, and it was decided to adopt a pipe of the same diameter as the largest hitherto built, namely 15' 6".

The engineers of the Hydro-Electric Power Commission say that they did not feel justified in advancing beyond the precedent of installing a pipe larger than 13' 6" in diameter, because of the serious damage to Fark property which would inevitably result, in account of large quantity of water involved, if a failure were to occur.

The use of pipe of this size eliminated the possibility of generally using the surface contours, as had been intended for the smaller one, and consequently a larger yardage of excavation was involved. The engineers say, moreover, that there was no time for the making of surveys and borings or for the preparation of detailed plans, and all studies and estimates had to be made on the basis of such data as were available in the original files of the Ontario Fewer Company. The essential plans for construction and installation purposes had to be issued while the construction work was actually under way.

The size and location of the new wood-stave pipe line, known as No. 3, caused the sugar Victoria Biagara Falls Fark Commissioners to require the backfilling of about three thousand lineal feet of the line. The magnitude

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of the pipe and its resultant inability to retain its circular form under heavy outside pressure made it necessary to place a concrete envelope around the section to be backfilled before the backfilling was placed.

Under these circumstances it was not possible to determine the relative proportions of earth and rock excavation or the location of such obstructions as dust-lines, water pipes and so forth, or for any of the detailed information concerned in the works for the surge tank and the addition to the power house building. The uncertainty in the matter of rock quantities also of necessity resulted in a similar uncertainty in concrete yardage.

To save time, the approximate weights and dimensions for the steel plate work were figured from the class of the Ontario Power Company and tenders were called for on the basis of a flat rate per pound for material to be subsequently estimated and ordered.

Malter Francis

Toronto, March 5th, 1923.

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WALTER J. FRANCIS & COMPANY.

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Addition Rado to Plant by

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Sature of Work	Qua	ntitio	15	
Jonduit				
Wood Stave Pipe	6,533	Lines	1 Feat	
Excavation, Earth	96.526	Cubic	Yarus	*******
Excavation, Rook	49,124	Cubio	Yards	*******
Concrete, Hass				
Concrete, Reinforced)	8,048	Cubic	Yards	*******
Backfill	79,809	Cubio	Yards	*******
Top Drossing	40.800	Square	Yard	S
Drains	11,239	Lineal	Foot	*******
Distributor				
55001	158.	.9 Tons		*******
Excavation, Earth				*******
Exeavation, Rook				********
Congrete, Mass and Reinforced				*******
Backfill	440	disk.	AN GAMM MANGE	********
endworks	1000	400		********
Mrye Tank Connection				
Excevation, Barth	266	Cubic	Ya wla	*******
Expavation, Rock				********
Concrete, Mass and Reinforced				********
Baokfill		***		*******
ridges and Culverts	*	496		****
urge Tank				
Steel	PEER	3 Tons		
Dicayation, Sarth				********
Excamplion, Rock				********
Concrete, Mass and Reinforced				*******
Brickwork	-			*******
Backfill		00010	Tard's	********
		-		********
alve Chamber				
Steel	34.	3 Tons		
Johnson Valves	4			*******
Excevation, Rook				*******
Concrete, Mass and Reinforced				*******
Ploors, Concrete	1,261	Square	Poot	********

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Hydro-Electric Power Commission

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	\$428,130.8	5	\$40,308.70		RACO AND WM		loon our		*** *** **	
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			40,969.00		144,579.39				Cubio	
					********				*****	
• • • •	4,071.30	******	1,620.00	******	5,691.50				Foot	
***	52,780.93		5,215.00	*****	57,995.91		WAR . OO	dieta alta Mali	Marin	
	1,367.64		560.00		1,927.64		365.00			War mill
***	5,780.81		2,300.00		080481	*****			Cubic	
***	25,027.84	*****	9,885.00		35,911.84				Cabic	
****	4,163,17		1,660.00	*****	5,823.17		***	2000	And the second second	Stranger, 400
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***	262.27	*****	120.00	*****	382.27	*****	7.44	*****	Cubic	Vand
****	7,962.51		3,170.00		11,132.31				Cubia	
***	11,682.90	*****	4,630-00		16,312.90				Cubic	
***	154.95	*****	80.00	*****	234.95		-	-		
	2,506.98	*****	1,100.00	*****	3,608.95	*****	***			
* * *	54,106.05		5,335.00		MO AAT OF		200 42	ativis sta Bada		
***	1,489.95		550.00		59,441.05		179.41			War and A
***	3,647.20	44444	1,500.00		5,347.28				Cubic	
***	2,547.15		990+00		3,537.15		21.97		Cubic	
***		*****	80.00		269.40		51.88	Agent,		
***	2,328.29		910.00	*****	5,236.29	*****	**	The same		4000
	5,623.23	*****	2,220.00	*****	7,843.23	*****	228.66	per	Ton	
***	139,501.65				150,556.65	**** 37	654.16	Eagh		
	9,472.19	*****	3,760.00	****	13,252,19	****	16.29	'ner	Cubic	Yard
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Addition Made to Plant by

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Quantities					
310.3 Tons 2,756 Cubic Yards 1,725 Cubic Yards 29,824 Cubic Yards 5,892 Cubic Yards	*****				
2,716 Cubic Yards 2,475 Cubic Yards 5,870 Square Feet 146.5 Tens	# a # > 0 0 0 0 0 0 0				

	310.3 Toms 2,756 Cubic Yards 1,725 Cubic Yards 29,824 Cubic Yards 5,892 Cubic Yards 2,718 Cubic Yards 2,475 Cubic Yards 5,870 Square Foot 146.5 Toms 2				

POWER COMPANY

Hydro-Electric Power Commission

Addition (continued)

)irect Costs		ndirect Cos	123	Total		Unit Co	sta		
	A 01 000 00		A 20 000 000							
***	\$ 80,970.04				-		\$286.67	per	Ton	
***	7,979.34 33,162.89		3,170.00		11,149.34		4.05	her	Cubic	Yard
	7,589.73		13,135.00		46,297.69		26.84	per	Cubio	Yard
	1,000,10	*****	3,010.00	*****	10,599.73	******	-			
***	94,823.87	*****	36,389.00	*****	131,212.87	******	4.48	Der	Cubic	Tarel
***	177,508.71		70,183.)0		247,691.71				Cubic	
	9,546.81	*****	8,760.00	*****	13,306.81				Oubic	
	79,450.00	*****	31,444.00	****	110,894.00		44.00		Phase To A	10° 1
	*****				** *** * * * * * * * * * * * * * * * *		*******	ber	Gubic	Iara
	24,687.10		4,870.00		25.557.10	****	201.75			****
•••	20,802.92		6,165.00		26,967.92	******	-	Sudday.	71 PARK	
***	176,255.36	*****	9,965.00	*****	186,220.36	******	-			
	21,971.84	*****	4,360.00	*****	26,331.84	******	******	****	*****	****
** 6	1,780.75	*****	360.00	****	2,140.75	******	******	***	*****	4 * * *
***	4,868.21	*****	950.00	*****	5,818.21	******	******	***	*****	
**	454.40	*****	80.00	*****	534.40	******	******		****	
**	565,847.48	*****	27,954.00	*****	593,801.48	******	******	***	*****	***
**	11,758.87	*****	1,190.00	*****	12,946.87	*****	******	***	*****	***
22	577.033.00		515,496.70	Sheet Control of the	.092.529.70					

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Addition Eads to Plant by Hydro-Slectric Power Commission Summary of Indirect Costs, Special Thurmes and so forth

Indirect Costs

Construction Plant and Machinery \$87,607.47	
Construction Railways 57,637.00	
Construction Roadways 12,196.92	
Construction Power, Light and Telephone 54,050.45	
Construction Water and Sanitary Systems 15,910.75	
Construction Compressed Air Systems 29,701.20	
Construction Plant Maintenance 113,381.29	
Auxiliary Plant Operation . O.P. X 142,342.74	
Tests and Inspection 3.036.24	\$515,864.04
Temporary Buildings - Credit \$367.34	367.34
Total *******	\$515,496.70
	And the second of the second o

Special Charges

Ad

arpenses securing	Labour *** x, Guy, Ga	
Police Protection	******* 43.720.56	\$45,780.39
field Engineering	and Superintendence	69,780.97

Head Office Engineering and Superintendence

Hydrau	110 38,774.01	
Mlectr	ical 22.467.19	61,241.20
	ation including Interest	010 005 27

No visit and was a figure of

Artist Control of the Control of the

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Addition Made to Plant

Comparison of Estimat

		The second secon	COLL BLL BOLL V.	
Nature of Work	Plants		irent ed Figure	・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・
ANDOMED OF MARK	Unit	Quantities	Total	Uni
This high rate rate with the control between the rest rate responses rate resources and resources are resourced and resources ar	etholetricolecent interactions relations removed the second contractions are also related to a second contraction as a second	tinne figure fit is more scanning and published an early algorithms.	Costs	Cost
Wood Stave Pipe and Saddles	Lineal Fast	6.630	6546, 000, 20	\$ 53.
Bosavation, Barth	Cubic Yarda		00201000000	& 00e
American, Rock)	Cupic Tards	. 150,000	105.000.00	
Backfill	Oubic Yaris	****		
Top Dressing /	Square Tards	********		******
Comorete	Cubic Tards	********	* * * * * * * * * * * * *	
Drains	Lineal Foot			******
Distributor		ş=-		
Steel	Tons	. 133	25,940,00	180-4
Expavation, Earth	Cubio Yards	********	********	
Axoavation, Rock	Cubic Yards	*****	*******	
Backfill ***********************************	Cubic Yards	* * * * * * * * * * * * *	********	*******
Concrete	Cubio Yards	*****	*******	******
	(())			
Surge Tank				
Steel	Tons	297.5	49,380.00	166.0
Excavation, Marth	Oubic Tards	** * * * * * * * * * * *	*********	******
Axoavation, Rock	Cubic Yards	******	******	*******
Backfill	Cubic Yards	********	*******	*******
Brickmork ************	Oubic Yards	* * * 6 2 7 6 6 7 9 6 8		****
Comprete	Cubic Yards	*********	* * * * * . * * * * * *	
Surge Tank Connection				
Excavation, Barth	Cubic Yards			
Excavation, Rock	Cupic Yarda		**********	
Backfill	Cubic Yards			********
Comerete	Cubic Yards		- * - * * * * * * * * *	
Johnson Valves	**********	- 4	130,000.00	52,500.0
falve Chamber				
	Tons	No	25,000.00	
	Oubic Yards		watersam	*******
	Cubic Yards	Estimated		
Penatooka	910 m			
Btool essessessessesses			36,180.00	180.0
Excavation, Rock	Cubic Yards	1,900	21,000.00	11.)
The state and state and				13.2

COPY FOR ENCLOSURE TO Mr. J. Allan Ross.

PON IR CONTANT

Hydro-Electric Power Commission

	through the wife the first the property of the	t of Items				of Items Hot		
	mantities		Unit	uenti	lies	Total	Unit	liemarks
		Costs	Costs	The third was the second of th	sendennye might store a radio	Costs	Costa	
		A						
		\$468,439.53	-			*		Figures show
		112,306.45			****	*********	********	include cost
	49,124	192,676.59	3.92		****		********	of saddles.
		*****				144,579.39	\$ 1.80	
	*******		*******		-			
	******		*******			208,850.70	25.32	
	*******		********	11,239)	5,691.30	0.50	
	de armus de	sample 20 March 20 Co.	district edition water, with mide.					
	158.9	57,995.91	365.00			* * * * * * * * * * * * * *	*******	
		*********				1,927.64	2.85	
		*********			2	13.080.8	4.21	
	安安教学预算标题案:	*****	****	1年景学学		5,823.17	40	
2 #		* * * * * * * * * * * * *	******	COO		34,912.84	54.70	
				CUP				
	331.3	59.441.05	179.41					
				Stantische in		1,989.95	3.35	
			***	900 40 10		5,347.28	7.01	
		*******				3,238.29	1.07	
**		*********	*********	The second second	2	259.40	51.88	
**		********		200		8,537.15	21.97	
* *	*****	******	********	2002		46201.70	Gods # # F	
				266	4	362.27	1.44	
			*********	1,18		11,132.51	9.39	
• •		**********				234.95	***	
				****	2	16,512.90	82.69	
						and A so draw a dr. m.	dun a dun	
	4	150.536.65	37.634.16	*******		******		
	**		And a Marian and a marian	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
	34.3	7,845.25	228.66	*********		*****	*******	
	812	13,232.19	16.29	**********	***		*******	
	698	20,407.89	29.24	******		,	*******	Includes con-
								prete floors.
	310.5	88,955.04				******		
	2,756	11,149.34				****		
	1,725	46,297.89	20.24				*******	



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Addition Made to Plant !

Comparison of Satimate

Nature of Work			res	
Magaze of solk	Unit	Quemtities	Total Costs	Unit Cost
Power House Substructure Excavation, Rock Beokfill Congrete	Cubic Yards	.) -	\$1.24,0 00.00)
Turbines, Governors, etc	*********	. 2	270,000.00	\$85,000.0
Brid es, Lino Crossin; etc		• •	10,000.00	-
Drainage			B.000.00	
Superstructure Steelwark	COPY Tons Gubic Yards	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	190,000.00	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
Generators and Electrical Ed			536,172.00	· Commo
Heating, Lighting, Ventileting Oil Supply and Com reased Ai			14,040.00	
		\$1	,710,212.00	
Angineering	*****		105,021.00	
		and the second		

\$1,815,233.00

add to 1.815,000.

Marson Marson

POWER CONTANY

Hydro-Electric Power Cormission and Actual Costs (continued)

and the state of t	Costs (cont	geternénetőkétér hazágyagyaráságai – V Tenketőken köznék szánákájánaljál hazákányajá veléphájállágás azákéda tan eszáltátán a delektorásákátásásásák				
etual Cor uantition	ot of Items B Total Costs	Secretary and the second second second second second second	Lentities To	oas Not Bet otal osts	Unit	Remarks
ed i tildetti variendenset refetatrisperijen	e ministra a marie de la composition della compo	territoria de como de territoria de la como de como de Como de como d			Coste	
	*					
29,624	\$131,212.67		*******			
5,892	247,691.71	42.04	***********	*********	*****	
300	The same of the sa				******	
2	186,220.56	93,110.18	**********	*******	*****	
100	3,608.93	-	*********			
See figur	es for Drains	s under various he	sdings	********		
4		*********	34.0	0 4 50		Hr. aaan
********	*********	********	2-3-3-2	10.56		No quantiti Kiven.
******	*******		7 T V 26,3	31.84	ngenta .	2 * * Crrs
			7PY 26,3			
146.5	29,557.10	201.75	**********	******	Tilled 1	Includes
2,475	110,894.00					loors and
**	26,967.92	****	***********	*******		loof.
2	593,801.46	296,900.74				
****	~~ ~ * ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	moogravet	* * * * * * * * * * * * * * *	****	*****	
*******	*******	***********	- 12,9	48.87	1000	
***	8,495.36	- +****	******	******	*****	
			eredet for foreste service transfer energia en artistation en state en agrado s'assessances en assessances and		aligo-ya wada'edd y ta nna e magaana nd	
\$2.	,561,038.30		\$511,4	91.35		
	And any or or not a stranger of the stranger o	en e	a annatesia kang kang kang antang pengangan manahari kang kang kang kang kang kang kang kang	NP Palestandelfaldly symentification () is no 2 person-analysiscenses.	teranti den sepundiber den den der er er er	
		\$5,092,529.6				
****	131.022.17	**********				
		*****		30.39		
*****	*********	***********	240,0	39.74		
20	712,060.47		\$797.2	£140		
A. A.	Transference (1987)		क्रमर ५००	W4.# WO		
	acher.	An continues as				
	_cost	\$3,509,321.98				

and the state of t 2800 THE REAL PROPERTY. The second secon 11 (1) (1) (1) , , SHAPE, SECOND -----KIND OF THE BEST OF THE BEST BEST OF THE BEST OF THE STATE OF THE STAT

Contract of Contract I amount

ONTARIO PORMS COLPARY

Addition Made to Plant by Hydro-Electric Power Commission

Increase of Costs Due to Increase of quantities on Baeis of Actual Unit Costs

Rature of Work	Natimat Quantiti		otual Di	fference	Unit Cost	Amount
Conduit Wood Stave Pipe Excavation, Sarth . Excavation, Rock	150,000	Lin.Ft. Qu.Yds.	6,833 96,526 49,124	33 Cr.53,474 49,124	\$71.70 1.16 3.92	\$ 2,366.10 Gr. 62,029.84 192,566.06
Distributor Steel	133	Tons	158.9	28.9	365.00	9,453.50
Surge Tank Steel	297	5 Tons	331.3	35.8	179.41	6,054.06
Penstocks Steel	201	Tons	310.3	109.3	286.67	31,333.03
Excavation, Rock		Cu.Yds.	2,756 1,725	85 6 625	4.05 26.84	3,466.80 16,775.00
Bubstructure*						
Excavation, Book" .	24,000	Ou.Yds.	29,824	5,824	4.48	26,091,52
Concrete*	2,600	Cn.Yds.	5,692	3,292	42.04	138,395.68
Backfill* *******	ent.		2,718	2,718	4.89	15,291.02
	appringuisti no di terminate di discontinui di terminate di discontinui di terminate di discontinui di terminate di discontinui di terminate di term	entalental discognitive differential de la respetta			Egyptinisk van Leen Haussjande Professor verprijstel de moarweld	\$377,772.95

^{*} Estimated quantities for Substructure assumed as under, to amount to \$124,000.00

Excavation. Rock .. 24,000 Cm.Yds. at \$3.00 = \$72,000.00 Concrete 2,600 Cm.Yds. at 20.00 = 52,000.00 Backfill = - - - \$124,000.00

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